THE VETERINARY JOURNAL

EDITORS: T. DALLING, *M.A., M.R.C.V.S.* J. McCUNN, *M.R.C.V.S., L.R.C.P.*

Vol. 104 April, 1948 No. 4

EDITORIAL

HORSES

ALL those who are interested in the horse must view with grave concern the serious reduction in the number of agricultural horses in this country. At a recent meeting of the Shire Horse Society it was said that the number had dropped by twenty per cent. between the years 1935-1946.

The increase in the amount of arable land, the urge for speed and man-power problems, have been largely responsible for this change. Recently the reduction in number has been accelerated by the butcher, for the shortage of other meat has brought a great demand for horse flesh. So great is this market that it has become a serious menace to our horses and especially to young stock. At present prices it pays to sell a young animal for slaughter rather than to rear and train it for four or five years. This saw that of 16,000 live foals dropped in 1946, 2,400 found their way to the slaughterhouse. A resumption of the foreign trade will give impetus to the demand. If such a state of affairs is allowed to continue, the horse stock of this country is doomed to extinction for the well will run dry.

Horses are essential to a balanced agricultural economy. They provide an efficient and cheap source of power, they live off the country, they play an important part in maintaining the fertility of the land, and they provide employment to a host of people, including wheelwrights, farriers, saddlers, corn merchants, attendants and veterinary surgeons.

There is no job on the farm or even, with few exceptions, in commercial transport, which cannot be done efficiently and economically by using horses. There are many jobs which they can do better than any mechanical contraption. The power they provide comes without the expenditure of precious dollars, and to the wise farmer they may also be a source of additional income. The yearly sale of one or two five-year-old horses will bring in enough to pay the rent of the average tenant farmer. These things are indisputable economic facts and in themselves should be sufficient to stem the tide, but there are other things which also count.

We are a nation of horse lovers and horsemen; our animals are the best in the world and in consequence, over the years, a considerable overseas trade has been built up. So on sentimental as well as for economic reasons it would be a calamity if the present trend should continue and the internal combustion engine, with the aid of the horse slaughterer, bring ruin to a great industry.

GENERAL ARTICLES

MUSCULAR DYSTROPHY IN LAMBS ("STIFF LAMB DISEASE") IN A FLOCK IN BERKSHIRE

By E. COTCHIN
Royal Veterinary College

In muscular dystrophy of lambs, which affects animals from about one to eight weeks of age, degenerative lesions occur in the voluntary muscles and, in most cases, in the myocardium also. The lesions in the voluntary muscles are often roughly bilaterally symmetrical. According to their severity, the lesions are accompanied by a stiff gait, a disinclination to run or walk, difficulty in rising or in maintaining the standing position, or inability to stand up or even to raise the body from the ground. Severely affected lambs may die in a very few days, but death in most cases is usually due to starvation or to complications such as pneumonia. Less severely affected animals may recover after a varying period of illness, but they show a considerable setback in growth. Slightly affected animals are less lively than normal and appear to become easily tired.

The disease has been given a variety of names, e.g., white muscle disease or white flesh (Vawter and Records, 1939), symmetrical muscle degeneration (Collins, 1939), myodegeneratio hyalinosa calcificans (Hobmaier, 1925), myositis (Ender, 1942), lamb rheumatism or lamb paralysis (see Willman *et al.*, 1934). The name most often used in the U.S.A., where the disease occurs naturally and has been closely studied experimentally, is "stiff lamb disease." However, as in England the term "stiff lamb" is often applied to an animal affected with any one of a number of conditions causing a stiff gait, the name "muscular dystrophy" is probably to be preferred.

Since it was first described, the general opinion has been that muscular dystrophy of lambs is of nutritional origin, and the condition has been noted to occur particularly after abnormally severe winters when the ewes are short of food. Experimental work in America has provided evidence that the disease may be both prevented and cured by vitamin E (Willman *et al.*, 1934, 1940, 1945, 1946; Sholl, 1939), but that treatment is not followed by a spectacularly rapid recovery. The experimental work so far reported appears to be bringing muscular dystrophy in lambs in line with the muscular dystrophy produced in small laboratory animals by depriving them or their mothers of vitamin E (see Mason, 1944).

The disease occurs in Europe, America, and Australia, but apparently it has not so far been recorded in England. Last year a number of cases occurred in a mixed flock on arable land in Berkshire. Lambing began at the beginning of March, 1947, towards the end of one of the severest spells of wintry weather this country has known. The ewes were fed on crushed barley, oats and peas, and rather poor quality hay, and were taken into the yard for lambing or as soon as they had lambed. As soon as the weather changed in the second week of March, the ewes were turned out with the lambs in the meadows during the day, but for a while were brought in again at night. During the next few weeks, several lambs

developed muscular dystrophy, but none of the ewes were affected. This freedom of the ewes from symptoms is the general experience in flocks where muscular dystrophy occurs, but nevertheless the condition has been reported in adults; e.g., Marston and Pierce (1942) noted the development of symptoms and lesions in ten ewes kept for three years on a semi-synthetic diet, and suggested that the condition was possibly due to the destruction of vitamin E by the linseed oil included in the diet. Vitamin E is known to be destroyed by rancid fats (see Bicknell and Prescott, 1942), but none of the lambs or ewes in the Berkshire flock were given cod liver oil.

By about the end of March a hundred or so lambs had been born. On the 24th, two or three of the earliest lambs were noticed by the farmer to be a little stiff in walking, and he found four or five more to be affected five days later. Two lambs were found dead on March 30, and three more the next day, by which time there were about 15 obviously affected lambs in the flock. Apart from these, the rest of the flock did not appear to be completely normal: all the lambs seemed to be disinclined to exercise, none were frisking about, and there was very little bleating, the lambs seeming in general to be listless and tired.

On March 31 one lamb was received alive for examination. Although the history given—of walking stiffly with a tip-toe gait—and the description of the rest of the flock at first suggested an outbreak of joint-ill, none of the joints of this lamb were swollen or painful, and there was no obvious pain, swelling or abnormal rigidity in the limbs. This lamb was now able to stand only when lifted to its feet, but it could then walk with a stilted tip-toe action; the chest appeared to be slung too low between the shoulder-blades, which projected a little upwards on each side to form a definite groove in the region of the withers. The lamb was destroyed by chloroform, and the characteristic lesions of muscular dystrophy were found in the limb and trunk muscles, especially in the muscles under the shoulder-blades—this possibly accounted for the abnormal position of the latter. Myocardial lesions were present, and also lesions of pneumonia. The same day another lamb died, with lesions in the muscles and lungs, and a further case died the next day, showing typical muscle lesions.

In view of American reports (Willman *et al.*, 1945, 1946) of the use of vitamin E in the treatment of muscular dystrophy in lambs, some tablets of "Ephynal"* were obtained from the local chemists: these were of the 3 mg. (human) size, and although it was realised that this dosage was very small, each of the obviously affected lambs in the flock was given two tablets by mouth. Bran was obtained for the ewes.

Through the courtesy of Roche Products Ltd., it was soon possible to obtain a supply of 50 mg. tablets of "Ephynal" for oral use, and of 30 mg. (1 c.c.) ampoules for intramuscular injection. The flock was visited on April 2. Thirteen lambs were found to be noticeably affected, showing varying degrees of muscular weakness, in some cases amounting to prostration. In addition, most of them

* "Ephynal" is the trade mark name of pure synthetic racemic alpha-tocopherol acetate —stabilised vitamin E, manufactured by Roche Products Limited, Welwyn Garden City, Herts. It is marketed in two forms—as tablets for oral dosage and in ampoules as an oily solution for intramuscular injections.

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showed signs of pneumonia, which in one or two cases was severe. Four of these thirteen lambs were given 200 mg. " Ephynal " by mouth, and the other nine were given 120 mg. intramuscularly. One of these lambs died the next day, showing only moderate muscular lesions, but a very extensive pneumonia was present, and was thought to be the cause of death.

The other lambs in the flock, 76 in number, were now each given 50 mg. " Ephynal " by mouth. The farmer reported a marked increase in liveliness in these lambs within the next two days, and only one of these lambs is known to have developed the typical symptoms of muscular dystrophy later. It seems quite probable that some at least of these 76 lambs were in the early stages of the disease when they were dosed.

By the middle of April eight of the thirteen lambs which had received the 200 mg. or 120 mg. doses of " Ephynal " had recovered, four were still about as ill as they were when they were dosed, and one, as mentioned, had died the day after dosing, probably from pneumonia. One of the group of 76 lambs was now affected, and this lamb and the four of the group of 13 that were still ill were given 200 mg. " Ephynal " by mouth on April 17. By this time about 150 more lambs had been born, but none so far had developed obvious symptoms of muscular dystrophy. By April 23, the five recently-treated lambs seemed almost better. Some of the other lambs had died, but were not received for autopsy : their deaths were attributed by the farmer largely to the shortage of milk among the ewes, as none had shown definite symptoms of muscular dystrophy. One of the five recently-treated lambs died on May 3, when it had been free from muscle symptoms for some time; at autopsy no muscle lesions were found, and death was attributed to the severe pneumonic lesions present.

On May 6 two further positive cases were examined *post-mortem*. There were now about 360 lambs in the flock. The general appearance of the younger lambs was not satisfactory, and a number of definitely affected lambs were present. Several lambs also showed lesions of ecthyma, and many of the ewes were short of milk. Two further cases died on May 9. In view of the marked improvement noted in the batch of 76 lambs that were given 50 mg. " Ephynal " on April 17, the farmer wished to treat the rest of the flock. Consequently, on May 12, of 250 previously undosed lambs, 125 were given 50 mg., and 125 were given 20 mg. by mouth. This left about 50 undosed. On the same day three live lambs were received for examination. All were given 200 mg. doses when received, but one died the next day, apparently from severe pneumonia. The two other lambs were kept under observation for a fortnight, one of them receiving a further dose of 300 mg. by mouth the day after it was received. At the end of the fortnight the two lambs had noticeably improved, but were still slightly stiff in gait. They were then slaughtered, and dystrophic lesions were found in the skeletal and heart muscle.

On May 15 two more positive cases died; these were from the group treated with 20 mg. " Ephynal " by mouth three days previously. A further member of this group died and showed typical lesions on May 16, as did another on May 20. From the group of 125 that were given 50 mg. " Ephynal," one died with typical

lesions on May 22, ten days after dosing, and one of the untreated group of 50 died on May 28, showing lesions of muscular dystrophy and an extensive pneumonia.

When the flock was again visited on May 29, the majority of the lambs were still not doing well. About a dozen showed some slight stiffness, especially of the hind-quarters: these lambs occurred in the treated groups as well as in the untreated. A few lambs showed pneumonia, and a few cases of ecthyma were present.

Summarising the above cases, between March 31 and May 30, 17 lambs showing lesions of muscular dystrophy were examined *post-mortem*. All showed lesions in the voluntary muscles, and all but two had lesions in the myocardium. Eight of these lambs also showed lesions of pneumonia. Nine of the 17 lambs had been given "Ephynal": of these, five had died, and four had been destroyed. Of the latter four, two had made a considerable recovery within a fortnight of receiving doses of 200 mg. and 500 mg. "Ephynal" respectively; of the two others, one showed slight lesions in the voluntary muscles three days after receiving 20 mg. "Ephynal," while the other, eight days after a dose of 20 mg., showed a severe pneumonia in addition to dystrophic lesions in the skeletal and cardiac muscles. Of the five treated lambs that died, all showing lesions in the skeletal muscles and all but one in the myocardium, three showed lesions of severe pneumonia. One of these five had received 6 mg. "Ephynal" two days, and 120 mg. one day, before death, another had received 200 mg. one day before death, another 20 mg. three days before death, the fourth 20 mg. four days before death, and the fifth 20 mg. ten days before death.

One batch of 76 lambs were each given 50 mg. "Ephynal" by mouth; only one of these subsequently developed obvious symptoms, and recovered after a dose of 200 mg. Of the group of 125 lambs given 50 mg. "Ephynal" by mouth, one died with dystrophic lesions, while of the group of 125 lambs given 20 mg., two died and two were destroyed with typical muscle lesions.

During the summer most of the lambs of the flock began to catch up in growth, and by the beginning of winter all were in reasonably good condition, except for about 30 that were on the small side. No further cases were observed after the end of May.

Lesions

The lesions of muscular dystrophy were usually very obvious to the naked eye, even when they were limited in extent, but in some cases a prolonged search of the muscles was necessary to reveal the lesions, and a histological examination was found useful in interpreting doubtful lesions. In this series of cases, myocardial lesions were present in addition to the skeletal muscle lesions in 15 of 17 lambs; however, other reports show that the myocardial lesion is not constantly present. On the other hand, in some cases described by Nörr (1938-9), which are possibly of the same type, and were characterised clinically by extra-systole, the lesions were confined to the myocardium. There is a distinct chance that mild cases of muscular dystrophy might be overlooked in an ordinary *post-mortem* examination.

Macroscopically, in the early lesions, the affected muscles or portions of muscle were surrounded by a clear rather gelatinous fluid, very pale yellow or very pale green in colour, and the cut surface of the muscle was also moister than normal. In the muscles could be seen very pale creamy-grey streaks of degenerated tissue, which extended to involve the whole or greater part of the muscle in severe cases. In these pale areas there were often seen sharply-defined dull-white areas of calcification. In two cases the fluid around and between the muscles showed tiny bubbles of gas, which could be seen to increase in size and number on exposure. The muscles of the hind-limbs and back were most often affected, but other muscles, particularly in severe cases, sometimes showed lesions, such as the intercostals and the abdominal muscles. Sometimes most of the limb muscles were affected, sometimes only one or two. The gastrocnemius muscle was affected in almost every case. There was often a strong suggestion of bilateral symmetry of the skeletal muscle lesions, both in regard to position and degree of involvement of any particular muscle.

The heart lesions varied considerably in extent. Occasionally the myocardium seen through the epicardium showed pale blotchy areas with ill-defined edges, particularly along the course of the larger coronary vessels. Usually, however, the heart appeared normal from the outside. The auriculo-ventricular openings were generally wide open, and there was usually a red clot in the opening. The lesions of dystrophy of the myocardium were seen as pale yellow-grey areas lying under a smooth endocardium free from thrombus, varying in extent from tiny linear sharply-defined streaks, or rather larger roughly rectangular patches with well-defined edges, to larger areas sometimes involving the whole or most of the subendocardial muscle in the heart chamber concerned. The lesions were present in most cases in the right ventricle, and when slight were often restricted to small areas near the origin of valve cusps, to the papillary muscles, or to the moderator bands. Similar lesions, but generally less extensive, were in some cases also seen under the endocardium of the left ventricle, and in two cases in the auricles. The degeneration of the myocardium extended into the heart wall for about 1 mm. or so in most cases, and there was usually a sharp, slightly irregular line of distinction between the normal and the degenerated muscle. In one case, however, the lesions extended right through the wall of the auricle, and, in another case, of the ventricle. In the pale yellow-grey areas of degeneration, dull white areas of calcification were usually present, often to a considerable extent.

No parasites were found in the alimentary tract, and, apart from signs of wasting in the longer-standing cases, and lesions of pneumonia, there were no important visceral lesions. There were no obvious macroscopic lesions in the brain or spinal cord. In two cases only was pus found in the joints, while two lambs showed umbilical and subcutaneous abscesses.

The histological picture in the muscles was sometimes very complex, but the general process appeared to be one of degeneration and fragmentation of muscle fibres, accompanied in the early stages by interstitial œdema and sometimes by infiltration of polymorphs, this being followed by a variable degree of calcification

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of the degenerated fibres (in accordance with the findings of Hobmaier [1925] and Marsh [1932], the calcium appeared to be present as calcium phosphate). Very soon there was an accumulation of mononuclear cells around the degenerated fragments, and the latter were removed chiefly by these mononuclear cells acting as macrophages, aided in some cases by polymorphs and, especially in the case of calcified myocardial fibres, by giant cells. Signs of muscle regeneration were present at an early stage, even in untreated or fatal cases, and in longer-standing cases the regeneration in some voluntary muscles appeared to be well advanced towards completeness. In the myocardium, the degenerative and reactive changes were of the same general nature as those seen in the voluntary muscles, and, although regeneration could not be identified definitely, it appeared to be foreshadowed histologically in some cases by a " streaming " parallel arrangement of long narrow ribbon-like cells which were possibly myoblasts.

The changes in the voluntary muscles are very like those described by Pappenheimer (1939) in the dystrophic muscles of the young of vitamin E deficient female rats. Although the vitamin E deprivation of the mother appears to result in the development of dystrophic lesions in the striated musculature of the offspring, the vitamin does not seem to be necessary for at least the initiation of regenerative changes. Hobmaier and others have drawn attention to the similarity of these muscle lesions in lambs to those seen in cases of paralytic myoglobinuria in the horse, and indeed Metzger and Hagan (1927), whose cases occurred the day the lambs were turned out to pasture, suggested that the condition in the lamb and in the horse might be of the same fundamental origin. Another condition in which rather similar but localised lesions develop in voluntary muscle is the so-called " traumatic myositis " of the masticatory muscles of the dog.

No lesions were seen in the vessels or nerves in sections of the affected skeletal or cardiac muscles, nor in the thyroids or costo-chondral junctions of which sections were made from two of the lambs. No inflammatory lesions such as those recorded by Csontos (1943) were seen in the brains and spinal cords of five lambs.

Summary

An account is given of the symptoms and lesions shown by cases of muscular dystrophy in lambs in a flock in Berkshire. " Ephynal " was used in the treatment of some cases, and given as a possible prophylactic to others, but an adequately controlled therapeutic trial was unfortunately not possible in the circumstances, and no definite conclusions as to the value of vitamin E can be drawn from the observations recorded.

Acknowledgments

Thanks are due to Roche Products Limited for the " Ephynal," and to Dr. F. Wrigley in particular for his interest; also to J. H. L. Addis, Esq., M.R.C.V.S., for providing the opportunity to examine these animals.

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* Seen in abstract only.

A NOTE ON THE INCIDENCE OF PSEUDOMONAS PYOCYANEA IN THE SEMEN AND SHEATH WASHINGS OF INFERTILE BULLS

By D. H. L. ROLLINSON

Ministry of Agriculture, Veterinary Investigation Laboratory, Reading

Introduction

THE association of *Pseudomonas pyocyanea* with infertility in the male bovine has been reported from time to time. In 1922, Gilman reported abscesses of the seminal vesicles of a bull which had become suddenly sterile and found them to contain this organism, in conjunction with a streptococcus. Other observers have also recorded its occurrence. In 1941, Gunsalus *et al.* reported the organism in five out of 19 bulls. Of these five bulls, three were withdrawn from an artificial insemination centre owing to poor fertility rates, the fourth became completely sterile, while the fifth gave a conception rate of only 12.1 per cent.

Cultural studies of semen have been made during routine examinations of bulls in herds where the fertility rate was unsatisfactory, and where circumstances were such as to render the bull suspect. The findings with regard to this organism are briefly presented, together with results of cultural examination of the organs of one infected bull *post-mortem.*

Methods

All equipment was sterilised prior to the examinations, by steaming (for one hour) or autoclaving (120 deg. C., 30 minutes). On return to the laboratory (within 1-3 hours) a loopful of each ejaculate and of the centrifugal sheath washing was plated on 5 per cent. ox blood-agar plates. Typical colonies of Pseudomonas were recognisable after incubation at 37 deg. C. for 24 hours. (Doubtful colonies were sub-cultured into broth, and then on to agar slopes.) Sub-cultures were made on agar slopes when the type of pigment became apparent. Tests for liquefaction of gelatine and fermentation of "sugars" were also made.

Results

Of 34 bulls examined, 14 showed evidence of infection (41 per cent.), the infection being present in both the sheath and the semen in 11 cases (79 per cent.), in the sheath only in two cases (14 per cent.), and in the semen only in one case (7 per cent.).

The 34 bulls examined were classified as under :—

(a) Degenerative changes	18 cases	7 infected	(39 per cent.)
(b) Hypoplasia	3 cases	1 infected	(33 per cent.)
(c) Semen normal, low fertility ...	4 cases	3 infected	(75 per cent.)
(d) Miscellaneous	9 cases	3 infected	(33 per cent.)

In those cases which were revisited, the picture of the infection was always similar. The length of time between tests varied from two weeks to three months.

Location of Infection in One Bull on Post-mortem

We were able to carry out a cultural examination on one animal in class (b) above. This animal was a sterile two-year-old bull, in excellent condition, and showed a very heavy infection of *Pseudomonas pyocyanea* in the sheath washings, and in every ejaculate collected at two visits, two weeks apart.

At slaughter no abnormality of the carcass was seen, the testicles were hypoplastic and the head of the epididymis was enlarged. The genital organs were removed in two parts, namely, the prepuce, penis, urethra, bladder, seminal vesicles, prostate and ampullæ in one piece, and the testicles, epididymis and a part of the vas deferens in another. The organs were wrapped in clean greaseproof paper, taken to the laboratory and submitted to further examination.

On reaching the laboratory the organs were laid out, and cultures were prepared from the representative parts.

Methods

The usual sterile precautions were taken in culturing; and as a rule a small quantity of 1 per cent. glucose broth was introduced into the organ with a Pasteur pipette, washed up and down and removed into a sterile test tube. This technique was found difficult in the vas deferens, for the examination of which a cut was made with a clean scalpel, the vas deferens seared, and then squeezed so that a droplet of the contents was extruded, which was collected on a platinum loop.

The washings obtained were incubated for 24 hours at 37 deg. C., and then sub-cultures were made on 5 per cent. ox blood-agar plates, when the organisms present were differentiated and further studies carried out.

Results

This examination showed the presence of Pseudomonas infection from the *sigmoid* flexture of the urethra to the head of the epididymis, the greatest infection appearing in the seminal vesicles.

The results are shown in Table I.

Discussion

While it is believed that the semen of infertile bulls contains relatively many more organisms than are seen in the normal animal (Anderson, 1945), their association with infertility is not yet clear. It may well be that some of the biochemical conditions present in the genitals of the infertile bull aid invasion by

TABLE I—DISTRIBUTION OF PSEUDOMONAS

Organ	Prepuce		Preputial Urethra	Sigmoid Urethra	Posterior Urethra			Seminal Vesicle		Ampulla	
	Ant.	Post			1	2	3	Left	Right	Left	
Pseudomonas	—	—	—	+	+	++	+++	+++	++	+++	
Other Organisms ...	S	C	S	—	—	—	—	—	—	—	

N.B.—S denotes Alpha hæmolytic streptococci. C den

bacteria; thus the more alkaline semen of the infertile bulls would seem to favour bacterial growth, while the effect of altered blood levels of the sex hormone is as yet unknown. It is believed that hormones affect the bacterial flora in the human vagina (Cruikshank, R., and Sharman, A., 1934, and Miura, H., 1928).

In the case of *Pseudomonas pyocyanea,* it appears that the invasion occurs long before any suspicion of infertility is present. Of the infected bulls quoted by Gunsalus *et al.,* three were under close supervision and were kept under good conditions in an artificial insemination centre; in the series reported in this paper, three of the four showed a lessened fertility rate, which could not be ascribed to any abnormality of the spermatozoa or semen. These cases had not progressed far, and it is likely that in time the effects might have been similar to those reported by Gunsalus *et al.* (1941). Since, as pointed out by Gilman (1920), and corroborated in this paper, *Pseudomonas pyocyanea* may infect the seminal vesicles, and other genitalia, it seems unlikely that infection, when once established, can be removed.

In the cultural studies on the organs reported in this paper. we did not recover Pseudomonas from prepuce, as had been possible during life. However, the volume of washing, and the area of the preputial mucosa covered by the *ante-*

mortem examination could not fail to detect this organism, whereas a washing of only 2 ml., on a limited area of the preputial mucosa, might explain this ambiguity.

Summary

1. The incidence of *Pseudomonas pyocyanea* in the semen and sheath washings of

IBUTIO UDOMONAS IN GENITALIA

l Vesicle	Ampulla		Vas Deferens		Epididymis				Testicles		Bladder
	Left	Right	Left	Right	Left Tail	Right Tail	Left Head	Right Head	Left	Right	
+	++	++	—	+++	+	+	—	+	—	—	—
	—	—	—	—	—	—	—	—	—	—	S

ococci. C denotes Coliform organisms.

34 infertile bulls is recorded; 14 (41 per cent.) showed the infection.

2. The relative numbers infected in each type of infertility is also recorded.
3. The location of infection in one sterile bull, suffering from hypoplasia, is set out.

Acknowledgment

The author is indebted to Mr. I. Haq for the use of his classification of the types of infertility. Thanks are also due to Dr. N. S. Barron and Professor T. Dalling for help and encouragement received.

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RELATIONSHIP BETWEEN BREED OF CATTLE AND ABILITY TO MAINTAIN A CONSTANT BODY TEMPERATURE UNDER TROPICAL CONDITIONS

By S. BRIAN KENDALL, B.Sc., M.R.C.V.S., A.R.C.S.

It has been customary to ascribe to each kind of domestic animal a "normal" body temperature, deviations from which are noted during the course of clinical examination and regarded as a sign of ill-health. The "normal," which for cattle lies between 101 deg. F. and 102 deg. F., applies, however, under temperate conditions only as the body temperature may rise when the atmospheric temperature becomes particularly high. Regan and Richardson (1938) in a series of laboratory observations on Holstein, Jersey and Guernsey cows, showed that rectal temperatures remained constant at approximately 101 deg. F. until the atmospheric temperature reached 70 deg. F., after which they increased. Between 80 deg. F. and 85 deg. F., depending on the breed of cow, a "pyrexial point" above which the cow was no longer able to maintain heat balance, was reached and thereafter the body temperature rose rapidly to as much as 105.1 deg. F.

In 1942, Hornby, commenting on some observations of body temperature in cases of trypanosome infection, stressed that particularly under tropical conditions it is an error to imply that there is a normal temperature for every species of mammal. The temperature of a healthy animal may show considerable fluctuation with rise and fall in the temperature of the environment. This conclusion received further support from observations made by Minett (1945) on several kinds of domestic animal including cattle. Hourly observations over twenty-four hours on hill-bulls and sheep showed that the body temperature started to rise about six a.m., followed an upward trend until early evening and then gradually fell to a minimum between one a.m. and four a.m.

Thus it appears that in cattle the maintenance of an exactly even balance between heat production and heat loss as indicated by an even rectal temperature is not invariable, although attained within relatively narrow limits by the animal when in health. Large increases in the body temperature may, however, be expected to have a deleterious effect on the health of the animal and in this connection French (1941) suggested that the failure to thrive often shown by European breeds of cattle when introduced to tropical countries might be connected with the abnormally high body temperatures which these animals developed under conditions of high atmospheric temperature. Since many countries where such observations have been made possess thriving indigenous breeds of cattle, it seems that native and imported breeds must differ in their ability to avoid overheating with consequent damaging rise in body temperature. That a variation in heat tolerance exists between various breeds of cattle was shown by Freeborn *et al.* (1934) who observed that Jersey cattle appeared more tolerant to heat than those of the Holstein breed. More recently Seath (1947) has made observations on the inheritance of heat tolerance in dairy cattle.

With this in mind, it was decided to make a series of observations on cows in the Government herd at Dar es Salaam in Tanganyika Territory (where the

writer was at that time stationed as Veterinary Officer), to determine whether the ability to maintain a constant body temperature throughout the cooler and hotter parts of the day varied with different individual cows and between native and imported breeds. The Dar es Salaam herd appeared particularly suited to the observation as it contained both Friesian cattle, including high-grade imported stock, and Boran cattle of a Zebu breed native to East Africa. It had been observed moreover that whereas the European cattle suffered considerable discomfort as evidenced by a greatly increased rate of respiration, bouts of panting and profuse salivation, the Zebu cattle did not appear to suffer from the heat. With the Friesian cattle a progressive decline in milk yield was observed and conception rate was low, while the Zebu cattle, although initially less heavy milk producers, maintained their yields and healthy calves were plentiful.

The cattle used for the observation were chosen at random and included high-grade and pure-bred Friesian stock imported from Kenya, locally bred Friesian-type cattle of lower grade and Zebus also imported from Kenya. The Zebu cattle were of the Boran breed and were considerably larger than the typical Tanganyika Zebus, being comparable in size with Friesian cattle of the same herd. All the animals under observation were cows in milk. Temperatures were taken with the animals at rest in an open-sided and airy milking shed after grazing in nearby pasture with light shade from palm trees. Temperatures were recorded daily at 5.30 a.m. and at 2.30 p.m. initially for sixteen days from September 20 to October 5 when atmospheric temperatures at 5.30 a.m. averaged 68.6 deg. F. with a relative humidity of about 94 per cent., and at 2.30 p.m. averaged 80.6 deg. F. with a relative humidity of the order of 62 per cent. The observations were repeated on six of the cows between November 7 and November 27 when morning temperatures averaged 70.8 deg. F. with a relative humidity of 68 per cent., and afternoon temperatures averaged 86.5 deg. F. at a relative humidity of 68 per cent.

Discussion

It will be noted that the rectal temperatures recorded at 5.30 a.m. during September and October (Table I) were obtained when the atmospheric temperatures were below 70 deg. F. and hence within the range of tolerance suggested by Regan and Richardson for European cattle. During this period, when the atmospheric temperature averaged 68.6 deg. F., rectal temperatures ranged from 101.2 deg. F. to 102.3 deg. F. for the Zebu cattle and from 101.1 deg. F. to 102.1 deg. F. for the Friesian cattle, there being no apparent relationship between the mean temperatures and the breed of cow. The average afternoon temperature of 80.6 deg. F. noted in the milking shed during the same period approximates, however, to the pyrexial point suggested by Regan and Richardson. Rectal temperatures for the Zebu cattle ranged from 101.4 deg. F. to 102.9 deg. F. with a mean of 101.9 deg. F., and for the Friesian cattle from 101.8 deg. F. to 103.1 deg. F. with a mean of 102.6 deg. F., and while the sample is small for an estimation of significance in the difference between these mean temperatures, it appears that at 80.6 deg. F. most of the Friesian cattle had higher rectal temperatures than the Zebu cattle.

TABLE I

Mean rectal temperatures recorded daily at 5.30 a.m. and 2.30 p.m. between September 20 and October 5 at atmospheric temperatures of 68.6° F. (morning) and 80.6° F. (afternoon).

Cow	Mean temp. 5.30 a.m.	Mean temp. 2.30 p.m.	Differences between a.m. and p.m. temperatures
(1) High-grade Kenya Friesian	101.3° F.	102.9° F.	1.6° F.
(2) High-grade Kenya Friesian	101.8° F.	103.0° F.	1.2° F.
(3) High-grade Kenya Friesian	101.6° F.	102.8° F.	1.2° F.
(4) High-grade Kenya Friesian	101.9° F.	103.1° F.	1.2° F.
(5) High-grade Kenya Friesian	101.4° F.	102.3° F.	0.9° F.
(6) High-grade Kenya Friesian	102.0° F.	102.8° F.	0.8° F.
(7) Zebu-European cross-bred	101.2° F.	102.0° F.	0.8° F.
(8) Low-grade local Friesian ...	102.1° F.	102.8° F.	0.7° F.
(9) Low-grade local Friesian ...	101.3° F.	102.0° F.	0.7° F.
(10) Low-grade local Friesian ...	101.1° F.	101.8° F.	0.7° F.
(11) Zebu from Kenya	102.3° F.	102.9° F.	0.6° F.
(12) Zebu from Kenya	101.9° F.	102.5° F.	0.6° F.
(13) Low-grade local Friesian ...	101.5° F.	102.0° F.	0.5° F.
(14) Zebu from Kenya	101.3° F.	101.7° F.	0.4° F.
(15) Zebu from Kenya	101.3° F.	101.6° F.	0.3° F.
(16) Zebu from Kenya	101.3° F.	101.6° F.	0.3° F.
(17) Zebu from Kenya	101.3° F.	101.6° F.	0.3° F.
(18) Zebu from Kenya	101.2° F.	101.4° F.	0.2° F.
(19) Zebu from Kenya	101.6° F.	101.7° F.	0.1° F.
(20) Zebu from Kenya	102.0° F.	102.0° F.	0.0° F.

The actual temperature rises for individual animals range from 0 deg. F. to 1.6 deg. F., six high-grade Friesian cattle showing the greatest and seven Zebu cattle showing the smallest increases in temperature during the day. The low-grade Friesian cows and the cross-bred Zebu show temperature increases of an intermediate order. This daily rise of body temperature, as an index of the ability of the animal to regulate its heat exchange, appears of more importance than the actual temperatures attained during the day since there is a considerable variation, apparently unrelated either to breed or to ability to thrive in the "normal" body temperatures noted in the animals at the lower atmospheric temperatures.

Reference to the herd histories of the cows under observation suggested that a diurnal rise of about 0.7 deg. F. under the environmental conditions of September and October indicates inability to thrive. This was confirmed by a further series of observations at the higher atmospheric temperatures of November (Table II). The trend of results is the same as previously noted, but it is seen that three Friesian cattle, previously showing daily temperature increases between 5.30 a.m.

and 2.30 p.m. of 1.6 deg. F., 0.8 deg. F. and 0.7 deg. F., respectively, now show corresponding rises of 2.1 deg. F., 1.9 deg. F. and 1.9 deg F., with average afternoon temperatures over the period of twenty days of well above 104 deg. F., a clear

TABLE II

Mean rectal temperatures recorded daily at 5.30 *a.m. and* 2.30 *p.m. between November 7 and November 27 when morning temperatures averaged* 70.8° *F. and afternoon temperatures averaged* 86.5° *F.*

Cow	Mean temp. 5.30 a.m.	Mean temp. 2.30 p.m.	Differences between a.m. and p.m. temperatures
(1) High-grade Kenya Friesian	102.5° F.	104.6° F.	2.1° F.
(6) High-grade Kenya Friesian	102.5° F.	104.4° F.	1.9° F.
(8) Low-grade local Friesian ...	102.6° F.	104.5° F.	1.9° F.
(7) Zebu-European cross-bred	101.5° F.	103.2° F.	1.7° F.
(13) Low-grade local Friesian ...	102.0° F.	103.1° F.	1.1° F.
(20) Zebu from Kenya	101.7° F.	102.1° F.	0.4° F.

indication of lack of balance between heat production and elimination. These animals had proved markedly unthrifty in the herd.

The observations may usefully be considered in the light of their application to animal husbandry in the tropics. The indiscriminate introduction to tropical Dependencies of European breeds of cattle has proved an expensive, and in the main, unremunerative undertaking. It is probable that no animal stocks adapted to meet predominantly cold conditions are likely to thrive in the tropics with the reversal of the environmental state under which their metabolism has evolved, although the individual differences in heat reaction observed suggest that the difficulty may be overcome by careful selection. In general, the most profitable development would be the improvement of heat-adapted local stock by selection of high-yielding strains. If importation of European cattle breeds is attempted an initial test both of breed and of individual heat tolerance is required.

Summary

It is shown that under tropical conditions in East Africa there is a relationship between breed of cow and the rise in rectal temperature associated with a rise in atmospheric temperature.

Cows of European breed, which do not thrive, show a greater rise in temperature than those native to the tropics.

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THE ERADICATION OF BOVINE TUBERCULOSIS FROM ISOLATED CENTRES*

By Dr. E. V. MOORE

Assistant Commissioner of Agriculture and Markets, Albany, New York

** Extended abstract of a paper delivered at the 51st Annual Meeting of the United States Livestock Sanitary Association, Chicago, Illinois, sent to us through the courtesy of Dr. A. H. Quinn, Kansas City.*—EDITOR.

A REVIEW of the record of our tuberculosis eradication programme in this country and in New York State shows the great task that has been accomplished and stresses the necessity of ferreting out the last isolated case of this great enemy of the livestock industry.

Thirty years ago bovine tuberculosis caused the greatest economic loss to the dairymen and beef breeders in this country. Since 1882, when Robert Koch, a German bacteriologist, discovered the micro-organism which causes this disease, the livestock industry has been planning some way to control it.

In 1916, a joint Federal-State plan was inaugurated to eradicate bovine tuberculosis from the entire United States by the test-and-slaughter method, with indemnity payments to the owners for reactors. Many then believed that this would be impossible. No other country had ever attempted such a large disease-eradication programme.

A statement compiled from the records of the United States Division of Meat Inspection shows that in 1917 the carcasses of 195,488 cattle were retained because of tuberculosis; 40,746 of these were condemned. This indicates how frequently advanced tuberculosis was found, but many animals in the advanced stages were not shipped to federally inspected packing houses. There were other slaughter-houses that did not have federal inspection where questionable animals could be consigned. During the same year, 76,807 hogs were condemned for bovine tuberculosis. These figures give but a partial idea of the magnitude of the economic loss from bovine and porcine tuberculosis in this country in 1917. The figures represent only the losses of animals slaughtered in establishments that were under federal meat inspection.

Professor H. R. Smith, General Manager of the National Livestock Loss Prevention Board, recently presented the following under the caption, "Bovine Tuberculosis Declines 98 Per Cent.": "The Federal meat inspection records, which give us a true picture of conditions, show that in 1916, the year before the national tuberculosis eradication campaign was started, 2.35 per cent. of all cattle slaughtered had tuberculous lesions. By 1943, only .048 per cent. of all cattle slaughtered under Federal inspection showed lesions and were retained for the disease—a reduction of 98 per cent. from the 1916 figure. The number of beef carcasses condemned has been reduced from 40,746 in 1917 to 1,248 in 1943, also a reduction of 98 per cent."

Bovine tuberculosis also caused considerable infection in man, but the full extent of bovine tuberculosis infection in man was not recognised until recently.

It has taken thirty years and 250 million dollars appropriated by the federal government, the states and counties to bring this disease under control. As a result of concerted effort, the national percentage of infection has been reduced to less than one-fourth of one per cent. Nearly four million reactors to the tuberculin test have been slaughtered; one-fourth of them originated in New York State.

In New York State, such an eradication campaign threatened to be particularly hazardous to the dairy industry because of our large cattle population and high percentage of infection. This state has spent more than sixty million dollars in addition to the millions spent by its counties and the federal government to reduce the average infection from 26.6 per cent. to .15 of one per cent. In New York State—and I assume this to be true throughout the United States—the decrease in the number of reactors and the lowering of the percentage of infection have created the impression that bovine tuberculosis is eradicated and that our Bureau of Animal Industry has been relieved of most of its work in connection with this disease. This is far from the truth. Bovine tuberculosis is still a threat to our livestock industry. The conservation of tuberculosis-free herds is just as important as their creation. They must be re-tested regularly to prevent re-infection. As evidence of the need for constant vigilance, during the fiscal year ending April 1, 1947, we tested 51,917 herds comprising 1,186,232 cattle, of which 1,835, or .15 per cent., reacted.

It will take longer to eliminate the last hundred reactors from our herds than it did the first million. We must constantly check our herds until the last reactor is removed. If this is neglected, the disease will re-establish itself in a few years and all the effort which has been expended on control will be lost.

The conservation of our tuberculosis-free herds is economically sound. The vast saving in beef alone has more than paid for all federal, state and county expenditures for the eradication campaign. Provided we keep the disease under control, this saving will continue to pay for the programme over and over again in the years to come. Tuberculosis eradication has been a paying investment. It is the first time that any contagious disease of such widespread and vast economic importance has ever been brought under control in an entire nation. It is a perfect example of what well-organised co-operative control measures can accomplish.

The federal meat-inspection records show that animals retained for tuberculosis increased 300 per cent. from 1908 to 1917. If the national programme of eradication had not been inaugurated in 1917, our situation at the present time would be similar to that in England to-day. L. Jordan, of the British Medical Research Council, states: "No less than 30 per cent. of the cattle in England are affected by tuberculosis. In England, 5.2 per cent. of all deaths in man due to tuberculosis are the result of the bovine tubercle bacilli and 25 per cent. of the deaths from non-pulmonary tuberculosis are due to the bovine tubercle. Milk samples from various cities show virulent tubercle bacilli in from 2.9 to 11.1 per cent." In his "Bovine Tuberculosis in Man," written in 1937, A. Stanley Griffith, of the British Royal Commission on Tuberculosis, states: "It is impossible to compute how many people have died from infection with the bovine tubercle bacillus since 1911, or what it has cost or is costing in providing institu-

tional treatment for crippled and in other ways incapacitated human beings. When to all this are added the economic losses from bovine tuberculosis among animals, the tribute paid to the bovine bacillus must be enormous."

We must not let our conditions revert to those in England; we must maintain the economic advantage we have won in controlling bovine tuberculosis. We have only to look at the record to appreciate the ground that has been gained. The death rate in man from non-pulmonary tuberculosis was 22.5 per 100,000 population in 1917. This had been reduced to 2.4 per 100,000 in 1945. During the same period, federal meat-inspection figures show that the number of cattle condemned had been reduced from 40,746 to 1,248, which is a reduction of 98 per cent. The same records show that hogs condemned for tuberculosis had been reduced from .19 per cent. in 1917 to .022 per cent. in 1943.

We are trying to solve the problem of eradicating the disease from the herds in which it still exists, for the small percentage of cattle left which harbour the infection can extensively recreate the disease in a very short time. We have realised for some time that when the routine testing procedure was applied to such herds it sometimes failed to reveal all of the open cases of tuberculosis that existed.

Our Bureau of Animal Industry, in a co-operative programme with the New York State Veterinary College, secured the services of Dr. Alexander Zeissig to study our tuberculosis eradication problems in New York State. Dr. Zeissig was then Bacteriologist at the Veterinary College and is now associated with the New York State Department of Health. His work has been very helpful to us in planning a campaign to control bovine tuberculosis in this state. Dr. Zeissig's report, entitled "Report on the Joint Project of the Department of Agriculture and Markets and the New York State Veterinary College at Cornell University for the Study of Problems in Connection with Tuberculosis Eradication," states:

> Participating in the *post-mortem* examination of the animals studied in this project soon taught us three things: First, reactors from herds subject to routine testing in clean areas prove on *post-mortem* to be mostly no-visible-lesion cases; second, most reactors from known infected herds show evidence of recent infection, the open case responsible being only occasionally found among them; third, the only way to comprehend what the tuberculin test you conducted has accomplished is to observe the *post-mortem* examination yourself.
>
> Two distinct problems became clearly defined: First, to reduce the slaughter of no-visible-lesion cases from non-infected herds, which objective we found re-testing would accomplish; and, second, and more important, it was obvious that routine testing was usually inadequate to detect the open cases in infected herds. We undertook studies in such herds to evaluate special procedures. Experience extending over a period of two years has convinced us that the field control of tuberculosis should be similarly divided.
>
> We recommend the following procedures based on this experience:
>
> **A. Routine Testing of Presumed Uninfected Herds**
>
> As long as tuberculosis continues to exist anywhere, there is always a degree of possibility of an infected animal being introduced into a herd due

to the interstate and intrastate traffic in dairy cattle. In order to detect these infected animals as soon as possible, routine testing of all herds of cattle should continue.

The veterinarian conducting a tuberculin test on a presumed uninfected herd is placed in a difficult position if he encounters reactions. Unfortunately, cows do not oblige by reacting either postively or negatively in a clear-cut fashion. The swellings presented to the veterinarian for his judgment range from the slightest enlargement at one extreme to the other extreme of fist-sized swellings in which there are hæmorrhage and necrosis. The latter are true tuberculin reactions due to a tuberculous infection. Experience has taught us that animals in which such severe reactions are seen will show evidence of recent infection on *post-mortem* examination. They are at the peak of the allergic state. Such reactions present no problem. The less conspicuous ones, however, either may be observed in an animal in which the allergic state has been dulled, as in one extensively infected, or they may be due to sensitisation with some other organism related to the tubercle bacillus. The veterinarian must decide which of these causes is responsible. We propose that the term " reactor " be applied to those reactions of unquestioned nature, and suggest that the term " deviator " be applied to those the significance of which is doubtful.

We propose that

1. All reactions, regardless of size, be recorded on the test chart.
2. If the accredited veterinarian would like assistance in interpreting the reactions which he observes, he be urged to seek consultation from a colleague of an official veterinarian.
3. The situation in each herd be thoroughly studied and evaluated before a decision is arrived at.

We suggest the following guiding principles :

Where Reactors are Found

If there is an unquestioned tuberculin reaction in any individual, all of the animals showing swellings of any size whatever, including deviators, should be condemned. The animal with the smallest reaction may be the open case which caused the outbreak.

Where Only Deviators are Found

a. Search carefully for skin lesions. If these are found in all deviators, the animals may be safely recorded as suspects and left in the herd.
b. Deviators without evidence of skin lesions, in practically all instances, can safely be left in the herd.
c. All deviators left in the herd shall be recorded as suspects.
d. They shall be re-tested on the opposite side in 60 days. On this re-test animals infected with tuberculosis will usually react as well or better than on the original test. On the other hand, in animals which would prove to be no-visible-lesion cases on *post-mortem*, the reaction, being of a temporary nature, will either fade or disappear altogether.
e. The final decision on the status of the animal shall be based on this 60-day re-test.

f. Where suspects are passed clean on this 60-day re-test, the entire herd should be re-tested one year after the date of the original test. This should be done even though herds in that area are ordinarily re-tested at greater than yearly intervals.

4. Herd status shall be based on the results of the *post-mortem* examination of the reactors slaughtered. For example, if reactors from an accredited herd fail to show lesions of tuberculosis on *post-mortem* examination, the accredited status of the herd shall continue without re-test.

B. Special Testing of Known Infected Herds

Routine testing of known infected herds is entirely inadequate to solve the problem of finding the open case. These herds require special attention. They should be in charge of a specialist who will work with the accredited and local official veterinarian in solving this problem. Such a specialist will develop skill kept keen by the experience obtained in frequent observation of true tuberculin reactions. He must also exercise considerable ingenuity in searching for the source of the infection.

We recommend that

1. The known infected herd must be placed under the strictest quarantine. Animals removed must be slaughtered immediately.
2. The *post-mortem* examination of the original reactors should be observed, if possible. If this is not done, the *post-mortem* reports should be carefully studied in an effort to determine if an open case was included in the original reactor group.
3. The herd should be subjected to special tests, such as the cervical or a modified subcutaneous.
4. The specialist should actually observe the *post-mortem* examination of all reactors which are removed from known infected herds. This is the only way that he can evaluate what he has accomplished by his testing and this practice also gives him a basis for deciding his future course of action.
5. Cattle with open lesions are almost always the source of infection. However, in rare instances where special tests (under 3) fail to reveal an open case in the herd, the possibility of a human as the source of infection should be investigated. Sometimes this search, too, proves fruitless. In one instance in a problem herd which formed part of this experiment, a dog was found to be responsible.
6. The entire purpose of this work with problem herds should be to find, and eliminate, the open case of the disease. All too frequently this animal does not react to routine tests and sometimes she gives only a slight reaction even with the special tests.

C. Post-mortem Examination

1. *Post-mortem* examination of reactor cattle should be observed by all veterinarians at every opportunity. If the accredited veterinarian cannot do this, then the official veterinarian responsible for that area should be present.

2. Meat-inspection reports contain only data required for the disposition of carcasses for human consumption. They are not satisfactory for disease-control work. They should be altered to include the necessary information, or a special supplementary form should be provided for the livestock sanitary official on which the information he needs would be recorded. The disease-control official is interested in whether or not the case was open, even if the tuberculosis is local. He would also like to know whether the animals slaughtered represented recent infection or whether the infection was of long standing. He would thus be in a position to gain some insight into the situation he faces in trying to eradicate tuberculosis from the herd.

In our Bureau of Animal Industry we have been following these recommendations of Dr. Zeissig in controlling tuberculosis in our problem herds, and the results have proved them to be both practical and effective. We are concentrating on herds where bovine tuberculosis is known to exist, and at the same time are testing all the cattle in the state at least every three years.

We believe that our programme is sound and that we are getting results. Constant vigilance is the premium we must pay to insure the continuance of our present favourable economic position.

REPORTS

ROYAL VETERINARY COLLEGE AND HOSPITAL

ANNUAL REPORT

For the Academic Year ended the 30th September, 1947

We very much regret to report the death of the Right Honourable The Earl of Harewood, K.G., a Vice-President of the College.

TEACHING

During the session 100 new students were admitted and 16 students returned from the Forces, making a total of 116, as compared with 103 new students and 27 students returned from the Services, total 130, in the session 1945-46. The total number of students at the beginning of the session was 428, the number for the previous year being 370.

At the examinations held by the Royal College of Veterinary Surgeons in December, 1946, 150 students presented themselves for examination and 109, or approximately 73 per cent., passed, and at the examinations held in July, 1947, 337 students presented themselves and 253, or 75 per cent., passed. The percentage of passes in December, 1945, and July, 1946, were 69 per cent. and 71 per cent., respectively.

During the year under report 55 students obtained the Diploma of Membership of the Royal College of Veterinary Surgeons, as compared with 60 who qualified in the previous year.

The number of students preparing for the B.Sc. (Veterinary Science) degree in October, 1946, was 85 enrolled in all years, compared with 84 in 1945.

A number of ex-Service graduates have asked for, and have received, refresher courses in various departments of the College.

RESEARCH

A. In the College

Department of Surgery and Obstetrics

Observations on the use of the metal detector in the location of metallic foreign bodies in cattle and other animals have been continued.

Department of Animal Husbandry

The endocrine aspects of reproduction in animals and, in particular, the application of hormone therapy in the treatment of sterility in the domesticated animals.

Department of Anatomy

In collaboration with the Department of Physiology, a study has been made of the cardiac output by the direct Fick method before and during hæmorrhage in anæsthetised horses.

A study has also been made of the blood picture in cases of purpura hæmorrhagica in the horse.

Department of Physiology and Biochemistry

Research on the respiratory reflexes in the mammal has been continued.

A chemical embryological investigation of the fœtal fluids of the mare and cat has been pursued.

A series of investigations on the biochemical aspects of two cases of purpura hæmorrhagica has been completed.

The work on Ricin has been continued with special reference to the anti-hæmagglutinin properties of immune serum and the colloidal properties of ricin solution.

Investigation is being made of the toxic properties of Water Dropwort.

A study has been made of some anthracine and tryptophan derivatives of possible biological significance and of certain aspects of the metabolism of tryptophan and its derivatives.

B. In the Research Institute of Animal Pathology

The factors concerned in the localisation of Corynebacterium renale in the kidneys of experimentally infected mice and the value of therapeutic agents in the control of C. renale infections.

The pathology and bacteriology of an experimentally induced nutritional disorder resembling white scour in calves, in collaboration with the National Institute for Research in Dairying.

A survey of the occurrence of illness and mortality among calves on a number of selected farms and of the methods of calf husbandry employed.

The occurrence and nature of disease among slaughter calves.

XUM

Further studies of some aspects of Johne's disease in experimentally infected goats.

The pathology and bacteriology of calf pneumonia.

Observations on the occurrence and nature of muscular dystrophy in young lambs and its response to Vitamin E.

Further studies on the developmental stages of Babesia bovis in Ixodes ricinus.

THE HOSPITAL

At the Beaumont Animals' Hospital, attendances numbered 16,607 compared with 16,708 the preceding year, 14,137 in 1945, and 13,683 in 1938. The decrease is accounted for in the quarter ended March 31, 1947, when the weather was unusually severe. During the quarter ended September 30, 1947, the number of attendances was 5,141, which is the highest number ever recorded in one quarter.

STAFF

Appointments

E. C. Amoroso, M.D., D.Sc., Ph.D., B.Ch., B.A.O., Chair of Physiology; J. T. Abrams, M.Sc., Ph.D., Lecturer, Biochemistry; P. R. Blair-Fish, B.Sc., M.R.C.V.S., House Surgeon, Steyning Practice; G. C. Brander, B.Sc., M.R.C.V.S., Lecturer, Medicine; E. Cotchin, M.R.C.V.S., Reader, Pathology; J. Hickman, M.R.C.V.S., Reader, Surgery; P. L. Ingram, B.Sc., M.R.C.V.S., Demonstrator, Physiology; F. T. W. Jordan, B.Sc., M.R.C.V.S., Demonstrator, Bacteriology; Mrs. D. Z. King, B.Sc., Demonstrator, Biology; I. L. Martin, M.R.C.V.S., Demonstrator, Surgery; P. Scott Dunn, M.R.C.V.S., Demonstrator, Animal Husbandry; G. W. Serth, M.R.C.V.S., Lecturer, Medicine; N. J. Scorgie, M.A., B.Sc., M.R.C.V.S., Courtauld Chair of Animal Husbandry, Veterinary Hygiene and Dietetics; Miss I. P. Vivian, M.R.C.V.S., House Surgeon, Beaumont Animals' Hospital; A. G. Warren, M.R.C.V.S., Demonstrator, Animal Husbandry; G. Williams, M.R.C.V.S., Demonstrator, Medicine; G. A. Willis, B.V.Sc., M.R.C.V.S., Lecturer, Animal Husbandry.

Resignations

Miss E. Barber, M.R.C.V.S., House Surgeon, Beaumont Animals' Hospital; J. D. Biggers, B.Sc. (Phys.), B.Sc.(Vet. Sci.), M.R.C.V.S., Demonstrator, Physiology; G. C. Brander, B.Sc., M.R.C.V.S., Lecturer, Medicine; Mrs. C. L. Bullen, M.R.C.V.S., Demonstrator, Bacteriology; H. Colson, M.R.C.V.S., M.R.C.S., L.R.C.P., Demonstrator, Physiology; O. G. Edholm, B.Sc., M.R.C.S., L.R.C.P., M.B., B.S., Chair of Physiology; Miss G. Halley, B.Sc., Demonstrator, Histology; E. W. Jones, M.R.C.V.S., Demonstrator, Anatomy; P. Kiddle, M.R.C.V.S., Demonstrator, Surgery; R. G. Mares, M.R.C.V.S., House Surgeon, Steyning Practice; Mrs D. M. Milnes, M.R.C.V.S., House Surgeon, Beaumont Animals' Hospital; W. R. Muir, B.Sc., Lecturer, Biochemistry; P. Scott Dunn, M.R.C.V.S., Demonstrator, Animal Husbandry.

UGANDA PROTECTORATE VETERINARY DEPARTMENT, ANNUAL REPORT 1945

THE livestock census for the year showed a total of 2,250,000 cattle, 1,000,000 sheep, 2,250,000 goats and 23,000 pigs. More than half the cattle are concentrated in the Eastern Province and practically all the pigs in Buganda Province.

Very serious depletions of European staff provided only one officer to each 600,000 head of cattle, but with the help of trained African staff it was possible to maintain the livestock industry. The increased meat consumption of the African population in the urban areas has produced a shortage of slaughter stock and a rise in the price of cattle. It has been necessary to introduce measures to prevent the sale of immature cattle for slaughter. The trade in goats, pigs, sheep, poultry, ghee and milk has either been maintained or increased. The reduction in the number of slaughter stock has produced a slight fall in the quantity of hides and skins exported.

The departmental policy of improving African methods of animal husbandry has made progress, especially in Buganda Province. African stock owners are shown the benefits of taking a personal interest in their animals, the feeding of locally grown supplementary food, controlled grazing, selective breeding, etc.

Tsetse has spread to north-east Buganda, causing closure of the stock trade route from Budali to Bugerere and Buganda. The field organisation set up by an interdepartmental committee, of which the Director of Veterinary Services is a member, has apparently stemmed the advance of *Gl. pallidipes* in northern Buganda. In southern Ankole experimental and survey work is being carried out in the *Gl. morsitans* belt under the control of an officer from the Department of Tsetse Research, Shinyanga. The areas harbouring *Gl. palpalis* and *Gl. fusci-pleuris* in northern Ankole are also being surveyed.

Trypanosomiasis is still the most important disease of cattle, and in 1944 11,000 head of cattle died in Bugerere from *T. congolense* and *T. vivax* infection. The drug Phenanthridinium 1553 in doses of 1 mg./kilo has proved to be very effective in the treatment of this disease.

Only two small isolated outbreaks of rinderpest occurred. An outbreak among highly susceptible cattle at Nagongera, Mbale District, was controlled by the use of Kenya Goat Virus vaccine. The other outbreak occurred in Toro District of the Western Province, the cattle having become infected from diseased game. Anti-rinderpest virus prepared from chick embryo was tested in 200 cattle in the West Nile District, but almost 100 per cent. broke down on subsequent test with Kenya Goat Virus. The response was attributed to poor keeping quality of the virus, which was transported from Kabete by aeroplane and used within 30 hours. Of 208 cattle tested with the new virus vaccine at Nagongera, 23 were challenged later with bovine virus and 4 broke down.

An outbreak of contagious bovine pleuro-pneumonia in Mbale District was due to the return from Kuramoja of stolen cattle. Although there was minor spread from the original focus, the outbreak was controlled adequately by a system of quarantine and slaughter.

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Kyoga skin disease, characterised by erythema and pruritis extending from the hump to the perineal region, occurs in Lango and western Teso. This disease is not fatal and systemic disturbance is slight, but continual licking of the affected part may produce sloughing.

East Coast fever, foot and mouth disease, blackquarter, anthrax and rabies occur sporadically in the Protectorate.

At the Entebbe Veterinary Laboratory 16,999 confirmatory and clinical diagnoses of field material were made. The course and symptoms of *T. congolense* infection in cattle were correlated with the blood changes and pathology. It is suggested that *T. congolense* has its main habitat in the skin, where it undergoes cyclic development. A decreased glucose tolerance was demonstrated in cattle with *T. congolense* infection, possibly due to liver dysfunction, by means of an intravenous tolerance test. Photosensitisation in cattle associated with the treatment of trypanosomiasis with Phenanthridinium 1553 was investigated. Work on the dosage and the administration of phenothiazine upon Strongyloides spp. in calves and sheep was carried out.

The Entebbe Veterinary School had nine students and the standard of teaching was maintained in spite of shortage of teaching staff. The school was moved to Kabete at the end of the year.

NOTES AND NEWS

POULTRY STOCK IMPROVEMENT PLAN

THE Minister of Agriculture and Fisheries has accepted the recommendation of the Poultry (Stock Improvement) Advisory Committee to introduce a Poultry Stock Improvement Plan, which the committee have drawn up as an extension of the existing Accredited Poultry Breeding and Hatchery Schemes.

The object of the plan, which has been accepted in principle by the main organisations of the poultry industry, is the improvement of egg production yields. It is not intended to cover table poultry production, but it is hoped to deal with that section of the poultry industry at a later date.

The plan is the outcome of prolonged investigation and deliberation on the part of a number of experienced practical poultry breeders and hatchery men with the assistance of the leading poultry scientists in Great Britain, and represents a combination of practical knowledge and modern scientific thought in poultry breeding. It is designed to influence every branch of poultry breeding for egg production, from the foundation stock breeder down to the commercial stock supplier and the egg producer.

The chief new features in the plan are :—

(1) The introduction of a scheme of progeny testing for foundation stock breeders.

(2) The introduction of a section to cover approved hatcheries and their supplying farms.

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(3) The introduction of official certification marks for the use of members in the various grades of the plan.

The various sections of the plan will be put into operation as and when circumstances permit. During the coming season, the accredited section, with the exception of the foundation stock grade, will be in operation. It is proposed that progeny testing, which is an integral part of the foundation stock grade, will be run on a trial basis by a small number of breeders for the first year.

The detailed regulations under which the various sections of the plan will be operated will be drawn up in consultation with the relative sub-committees of the Poultry (Stock Improvement) Advisory Committee and the organisations of the poultry industry concerned.

FEEDING YOUNG GRASS TO BEST ADVANTAGE*

YOUNG spring grass is a very rich food and quite different from the usual winter ration. It is succulent, low in fibre and rich in protein. Too much of it causes scour. It is well known that this scouring, if allowed to continue unchecked, may lower the milk yield and cause animals to lose condition. To counteract scouring it is desirable for a time to continue giving some dry food. Good oat straw or moderate quality hay should be offered at home or in the field and the animals left to adjust the fibre content of their ration for themselves. This they will generally do quite effectively. It is a good plan at the beginning of the grazing season to accustom the stock gradually to the change of diet. If they have not been running out through the winter they should at first be allowed on the best pastures only for short periods. Many dairy farmers believe that it pays to ration the grass at all times of the year and not simply in the spring, arguing that when the stock are allowed free range much good grass is fouled and wasted. Usually these men allow a two-hour grazing period at either end of the day, and the stock spend the rest of the time chewing the cud on poorer or barer pastures.

But when the stock are grazing very succulent herbage it is also necessary to be on the look out for bloat or hoven. The danger is greatest when hungry animals consume too quickly young herbage containing a good deal of clover, especially when it is wet. And this heavy milkers on the "on and off" system are apt to do when they realise that they will be turned back to poor pasture after a short spell. As a rule the trouble does not arise when the animals have access to coarse fodder. American investigators explain this by suggesting that the lack of fibre in the diet immobilises the internal arrangements which cause belching and the expulsion of the gases formed in the rumen. Some British research workers contend that bloat is a form of protein poisoning. On this assumption workers in Northern Ireland obtained good results from injections of adrenalin. These results were subsequently confirmed by trials in Yorkshire. Judging by the number of cases reported, the trouble seems to be on the increase.

* Ministry of Agriculture News Service, March 16, 1948.

THE SCIENTIST LOOKS INTO THE FUTURE*

RESEARCH work on the livestock problems confronting farmers is proceeding actively. As regards breeding, results must be slow to appear, but data are being collected that will provide the necessary facts. Livestock improvement becomes more difficult as every advance is made, and a breeder is limited by the facts that he has but few animals and lives long enough to breed but few generations. The geneticist surveys a wider field, and by working with progressive breeders he should materially shorten the time taken to breed animals that are really suited to the many very different environments found in this country.

There is the internal make-up of the animals to be considered, too, and workers are gaining knowledge of the animal's internal processes—knowledge that may lead to developments in production greater than nature intended. Already it is possible to bring a virgin heifer into milk and—of more practical promise—to raise the yield of a cow already in milk by 20 to 30 per cent., increasing the milk's fat percentage at the same time. Iodocasein, which can be manufactured in any required amount, will increase fat percentage, though only at the cost of some harm to the cow. But experiments are going on to see whether, by being content with a rather smaller increase, no harm will come to the animal, and the chances seem good. It is expected that within the next ten years it will be possible to stimulate a cow's ovaries to shed many more eggs, to wash out these eggs, fertilise them and implant them for development in other cows. And in this way, with the aid of a number of scrub cows to act as incubators, we may be able to get 200 to 300 calves in a year from a valuable cow.

* Ministry of Agriculture News Service, March 23, 1948.

SUGAR FROM SALT*

IT was a most distinguished American who once shocked the world by stating frankly that " History is bunk," and almost every one of us; some time or other in our earlier days, wondered if it were worth all the fuss our elders seemed to make of it. But the lessons of history can be useful when it comes to getting out of tight corners. We are so apt to pursue the latest novelty, the latest tennis champion, the latest discovery or the latest fertiliser, that we overlook the virtue in the practice of our grandfathers. Fortunately, when we ran short of potash, the historically minded among us remembered common salt, which for centuries was a useful fertiliser for many of our crops.

Scientists have examined salt afresh, and confirm that our grandfathers were right—it is a good fertiliser, especially for mangolds and sugar-beet, particularly on light soils. The workers of Rothamsted found that it is often as effective as muriate of potash for sugar-beet, and that it seems to help plant leaves to resist drought. Other workers have found that 5 cwt. of salt gave 5.1 cwt. sugar, as against 3.4 cwt. when potash was used, plenty of nitrogen being supplied in both instances.

* Ministry of Agriculture and Fisheries News Service, April, 1948.

In addition to its fairly common use on mangolds, salt mixed with nitrate of soda was for long a popular top-dressing for wheat in some parts of the country. It has also been used for other cereals, notably barley on light soils.

On grassland, salt helps to destroy such weeds as yellow rattle, ox-eye daisy and nettles, and it is popularly believed to induce animals to eat down rough grass. But both our grandfathers' and the scientists' evidence on the last point is contradictory and inconclusive. It is true that at certain seasons, particularly in regions far from the sea, animals deprived of rock salt will greedily eat almost any kind of herbage, including nettles, over which salt has been sprinkled.

Farmers commonly add salt to damaged hay to prevent mould in the stack and increase palatability, but few seem to have tried the effect of adding salt to good hay as a means of preserving colour and feeding quality, and avoiding loss of leaf by reducing the interval and the handling between cutting and stacking.

On the other hand, salt depresses the yield and quality of potatoes. In strong solutions it has been used as a weed killer. Charlock in mangolds and sugar-beet has been destroyed by a 20 per cent. solution applied at the rate of one hundred gallons per acre on a dry, hot day.

In all, there seems a lot that can be done with salt on the farm. And as it hasn't to be imported, complicated questions like exchange do not arise.

REVIEWS

Animal Breeding. By A. L. HAGEDOORN, Ph.D., State University, Leiden. Pp. 304. London: Crosby Lockwood & Son, Ltd. Second edition, 1946. Price: 15s. net.

THE wide appeal of Dr. Hagedoorn's well-known book is indicated by its having reached a second edition, and in all its fifth reprinting, albeit this second differs in no material content from the first edition. Dr. Hagedoorn's approach to the subject of animal genetics is avowedly popular for, as he says, his aim has been to produce "a book for the breeders themselves" which would give "enough of the working of the methods they are using, or those they should use." As one might therefore expect from this description, over-simplification of some of the subject matter of genetics has led the author into occasional inaccuracies, but one must nevertheless agree that he has succeeded reasonably well in his popular exposition of a science which is, perhaps, the most difficult of all the biological disciplines to put across to the layman without having recourse to the excessive use of technical terms and obscurities.

Perhaps British veterinarians, in common with others without the profession, may have become faintly suspicious of the over-publicisation and reiteration in a section of the agricultural weekly press of Dr. Hagedoorn's opinion regarding the deplorable state of animal breeding in this country. Let not any such feeling, however, if it does in fact exist, lead us to omit his book from our reading, for the author has much to say in regard to procedure in livestock improvement which is apt and worth listening to. He exposes with much confidence the fallacies and humbug that hold far too prominent a place in the breeding and advertisement of pedigree livestock to-day. The veterinary surgeon, to whom, perhaps, above

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all others, training and experience bring better appreciation of the relative importance in animal breeding of utility characters on the one hand and of fancy points on the other, will read with no little degree of amused satisfaction Hagedoorn's castigation of the false standards of the show-ring and the meaningless, but obligatory, trademarks of the breed societies. Perhaps one may feel that the author, in administering his corrective treatment, tends consistently to "o'er-leap himself and fall on the other side," thus neglecting to give due credit to the work which pedigree societies have undoubtedly contributed to the selection of better animals.

Such comments as we have made on Hagedoorn's views regarding methods of selection in animal breeding are advanced in no carping spirit, for on the whole we believe that the reader cannot but find this author's opinions usefully provocative and stimulating. Anyone with even the merest interest in progressive animal breeding, as distinct from animal multiplication, must find himself in sympathy with Hagedoorn's ideal, *viz.*: "My own attitude has been consistently this, that we should aim to make each breed of domesticated animal as good as possible to fill its niche in the symbiosis-group in which it exists."

It is perhaps a hope in vain that one type of animal-keeper, unfortunately still prevalent and who is well described in the words of the older Huxley as "the practical man, he who repeats the errors of his forefathers," will be constrained to give up his traditional and empirical methods. But to those who are less settled in the ignorance of misconception, a knowledge of genetical principles and their application to animal breeding, both well enough described in Dr. Hagedoorn's book, will furnish a more rational approach to the selection of livestock for their economic qualities than will the deficiencies inherent in the practical "art" of stock-judging.

N.J.S.

Adolescent Sterility: A Study in the Comparative Physiology of the Infecundity of the Adolescent Organism in Mammals and Man. By M. F. ASHLEY MONTAGU, Associate Professor of Anatomy, Philadelphia. Pp. ix + 148. Springfield, Ill.: Charles C. Thomas, 1946. Price: $3.50.

IN this book the author marshalls an impressive collection of data in order to show that the capacity for successful reproduction in the female of most mammalian species is not synchronous with the advent of puberty. The sexual changes which are initiated in the organism at puberty through the agency of the awakening endocrine glands culminate after a variable interval with the establishment of ovulation as a more or less rhythmic and regular function in the sexual cycle. This phase marks the stage of development at which the organism first becomes capable of conceiving and reproducing, i.e., the stage of "***nubility***." The interval of time elapsing between puberty and nubility supplies the title to the book, viz. "adolescent sterility," which is defined as that period during which, in a given population, a majority of the normally developing individuals are incapable of conceiving, while those which do conceive either suffer a high maternal mortality-rate or exhibit a high proportion of abortions.

In support of his thesis Dr. Ashley Montagu presents confirmatory evidence from widely diverse sources, anthropological, physiological and demographic, and

also cites experimental observations that have been made on reproductive processes in mice, cattle, monkeys and primates. A brief reference is made to the well-known study by Winters and his colleagues at Minnesota on the prenatal development of the cow, in which it was found that normal heifers bred at their first or second œstrus yielded a considerably higher proportion of abnormal ova, both fertilised and unfertilised, and also of degenerate early embryos, than would be expected from healthy mature cows. One may interpolate here that the inadvisability of breeding at the onset of puberty and for some time afterwards has long been recognised by breeders of domestic animals, which fact, according to Dr. Ashley Montagu's statement, seems to have been less well understood by those concerned with the study of primitive or of civilised human societies.

In his presentation of evidence from anthropological and sociological literature, the author appears to be more at home than he is with the physiological data, his treatment of which is somewhat laboured and tends to excessive and sometimes irrelevant quotation. Despite this criticism, the book is worthy of the attention of everyone interested in the biology of reproduction, on account of the information and references which the author has assembled from sources not ordinarily consulted or known by the student, or even by the specialist, in the purely physiological aspects of mammalian reproduction. N.J.S.

The Earth's Face. Landscape and Its Relation to the Health of the Soil. By EHRENFRIED PFEIFFER. London: Faber and Faber. Price: 12s. 6d. net.

THIS is a book which will command the thought and attention of all who are fortunate to read it and whose vision goes beyond man-made things. For the last hundred years or so most people have associated industrialisation with prosperity, comfort and well-being. This is not surprising, for industrialisation has greatly advanced the standard of life of the wage-earners. The latter have crowded into the towns where they enjoy all the amenities of modern civilised life. They have been able to purchase all the things which sustain life, and as long as they could keep in employment any planning for future needs of sustenance only meant another visit to the tradesman. A generation has grown up which only knows the countryside as a pleasant place to spend the hours of recreation. Many have lost all knowledge of what might be called natural history or country lore, their appreciation of Nature being measured by their visual and olfactory senses. Many could not give the trees their names. This wave of materialism has to some extent affected their country cousins who have profited from the demands of the teeming masses in the towns and this trend has been accentuated by two world wars. The existence of all living things depends upon a well-defined balance and normally Nature only destroys in order to recreate. Once this balance is upset, then the face of the earth shows signs, to those who have eyes to see, that all is not well and that the forces of destruction are making headway as is the case in disease of the body. This is no new thing for there are scars on the earth's surface which remind us constantly of the errors of the past, i.e., the Saharah and the dust bowl of the Middle West.

Dr. Pfeiffer studies the earth as the physician might study his patient. His

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signs and symptoms are reflected in the landscape. He can not only note the presence of disease; he can point out the conditions which will lead to disease and how they may be remedied before it is too late. If these warnings pass unrecognised whole areas will become sterile and useless and unable to support animal or plant life.

If this process was carried to a conclusion, this planet could in course of time become as is the moon.

If we are to continue to support an ever-increasing population the remaining available areas of fertile land must produce to capacity.

If the teachings of Dr. Pfeiffer's book are followed, and those teachings are based upon the preservation of the laws of balance, which are indeed those of Nature herself, all will be well. Man must follow Nature; if he does so, then his inventions will serve for his preservation and not his destruction.

This book will interest and intrigue all who are students of natural history, not the least of whom are veterinary surgeons.

It is illustrated and there is an appreciative foreword by Sir R. George Stapledon.

CORRESPONDENCE

The Editor, THE VETERINARY JOURNAL.

DEAR SIR,—I am directed by the Council of the Australian Veterinary Association to draw your attention to a statement in an article headed "Australia Safeguards Animal Health" in THE VETERINARY JOURNAL, Vol. 103, No. 11, November, 1947. This statement reads as follows:

> "Australia has learnt the importance of safeguarding animal health by costly experience. Some years ago the poultry disease psittacosis was introduced and thousands of birds had to be destroyed before the disease was eliminated."

It has probably occurred to you that such a statement is without foundation. Psittacosis has been present in Australia for many years and whether or not it was introduced since the country was settled by white people is unknown. In a sub-clinical form, it is widely present in birds of the parrot family. No attempt has ever been made to eliminate it because such action would be practically impossible. The writer is probably confusing psittacosis with Newcastle disease of poultry.

As the statement in the article referred to would be quite at variance with any scientific reports from Australia, it is thought desirable to draw your attention to it.

Yours faithfully,

MAX HENRY,
Secretary.

The Veterinary School,
University, Sydney.
February 25, 1948.

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OBITUARY

Lt.-Col. H. A. REID, O.B.E., F.R.C.S., D.V.H., F.R.S.E.

HARRY AVERY REID died on Sunday, September 14, 1947. The news of his sudden death came as a great shock to his many friends in this country, for he was one who had won the respect and esteem of his contemporaries. He was born in London in 1877, being the son of A. Reid, of Walberton, Sussex. His maternal grandparents lived in New Zealand.

He was educated at Oakfield School, Liverpool University and at the Royal Veterinary College. He qualified M.R.C.V.S. on July 14, 1900.

In 1901 he went to New Zealand and joined the Government service. He resigned in 1902 to proceed to Egypt. In 1904 he was senior veterinarian in charge of the Serum Institute at Cairo. He studied at the Pasteur Institute during the 1904-5 session.

In 1907 he re-entered the New Zealand service as Bacteriologist and Pathologist to the Department of Agriculture. He served in the New Zealand Forces during the 1914-18 war, attaining the rank of lieutenant-colonel and holding the post A.D.V.S. to the New Zealand Division. On December 1, 1936, he returned to London to take up the position of Veterinary Officer in the High Commissioner's Office.

He made numerous contributions to veterinary literature, including the book on "The Diseases of Farm Animals in New Zealand."

His quiet and courteous manner coupled with an evident efficiency in his profession gained for him a host of friends.

He had a wide experience in the laboratory, in the field and in administrative duties, and this, coupled with his great knowledge of men and affairs, made him a charming host and a sage counsellor. Reid was always willing to pass on from his great store of knowledge.

The profession can ill-afford to loose such men, especially one who formed such a solid link between the Mother Country and the lands overseas.

Publishers' Notices

Copy of advertisements should be in the hands of the publishers—Baillière, Tindall and Cox—not later than the 1st of the month, if proof is required.

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Lt.-Col. H. A. Reid